

EPR Evidence of Unusual Dopant Valency States in Nanocrystalline Er-doped CeO₂

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Abstract

© 2015, Springer-Verlag Wien. The structure and oxidation state of the Er dopant cation in CeO₂ single crystal and nanocrystals with size ranging from 22 to 300 nm are studied using electron paramagnetic resonance (EPR) spectroscopy at X- and at Q-band near liquid-He temperatures. Besides the expected EPR line due to Er³⁺ in cubic sites in the lattice, unusual EPR lines with g values around 14 and 20 are observed in nanocrystalline CeO₂. The appearance of these lines suggests the formation of non-Kramers Er²⁺, Er⁴⁺ ions, which becomes increasing favorable with decreasing nanoparticle size. Formation of rare earth ions with such unusual oxidation states in nanoparticles can be exploited in tuning their catalytic activity and optical properties.

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